

ECMWF's activities and plans



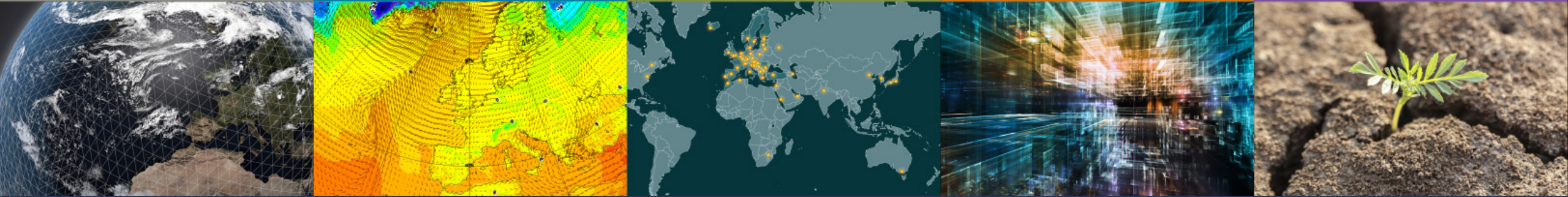
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GLOBAL FORECASTS

SERVING METEOROLOGY

SUPERCOMPUTING

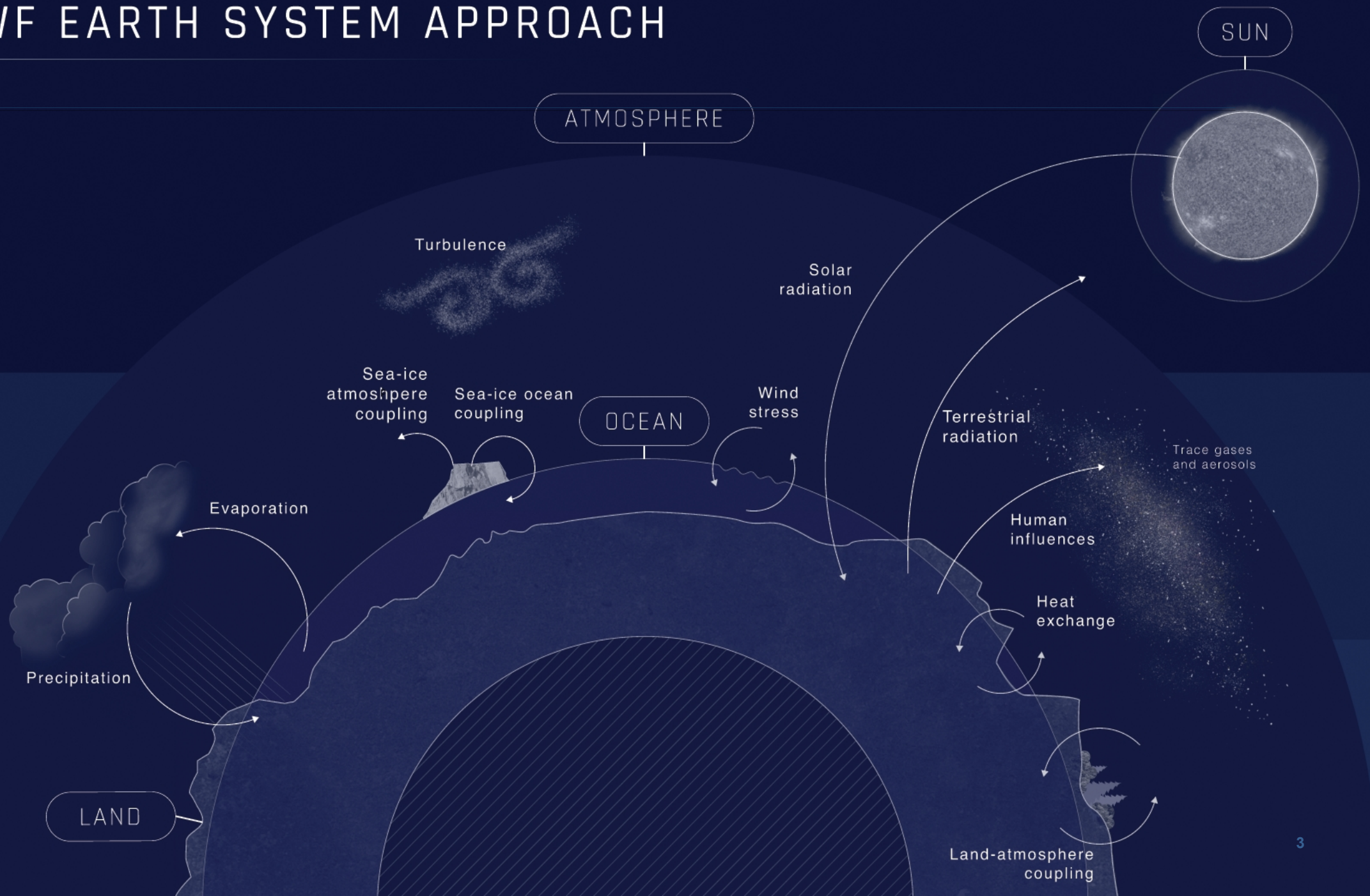
ENVIRONMENTAL SERVICES



Delivering global predictions



ECMWF EARTH SYSTEM APPROACH

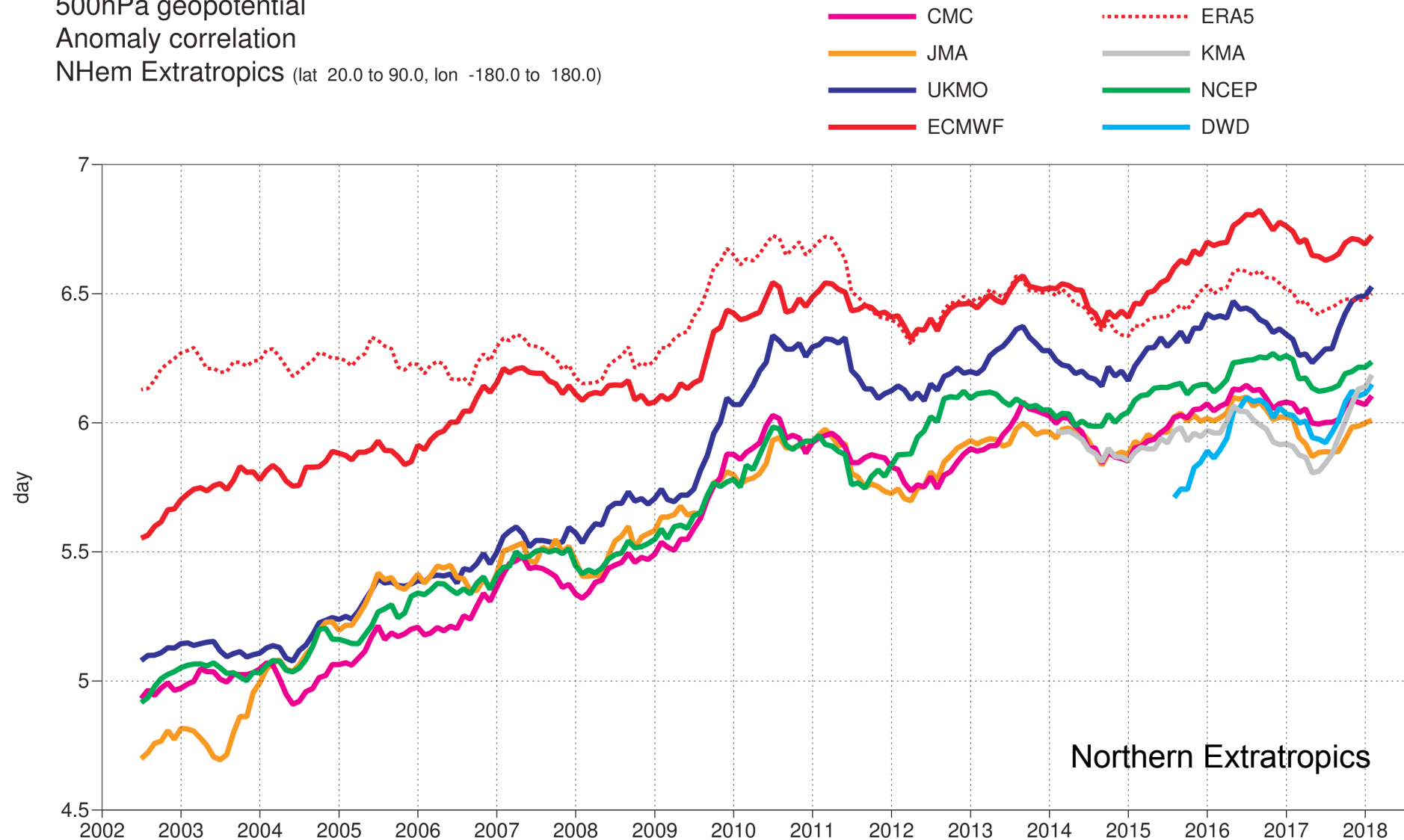


Anomaly correlation of 500 hPa geopotential reaching 80%

500hPa geopotential

Anomaly correlation

NHem Extratropics (lat 20.0 to 90.0, lon -180.0 to 180.0)



Northern Extratropics

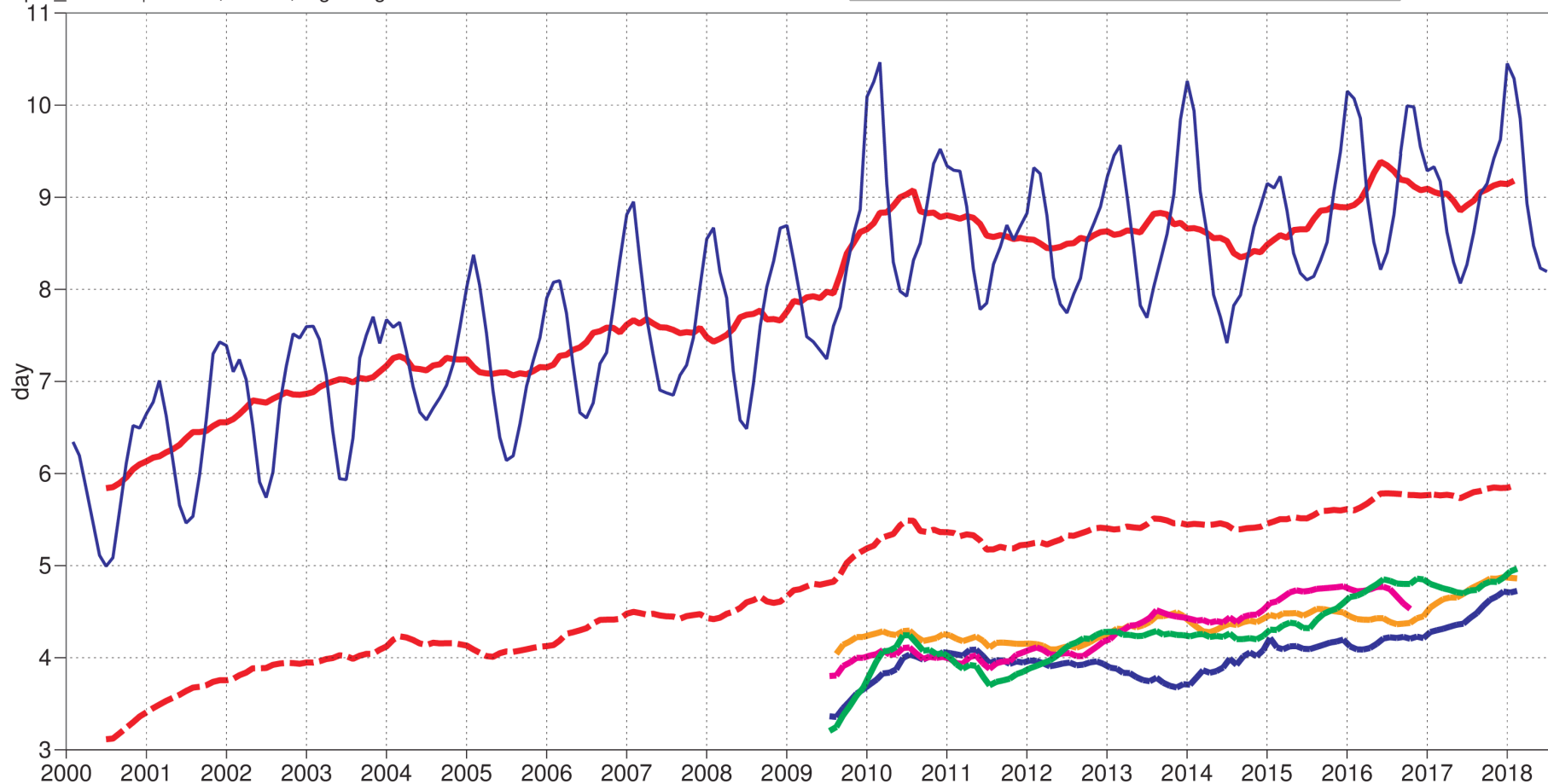
T850 hPa ENS performance

850hPa temperature

Continuous ranked probability skill score

NHem Extratropics (lat 20.0 to 90.0, lon -180.0 to 180.0)

oper_an enfo | 00UTC,12UTC,beginning



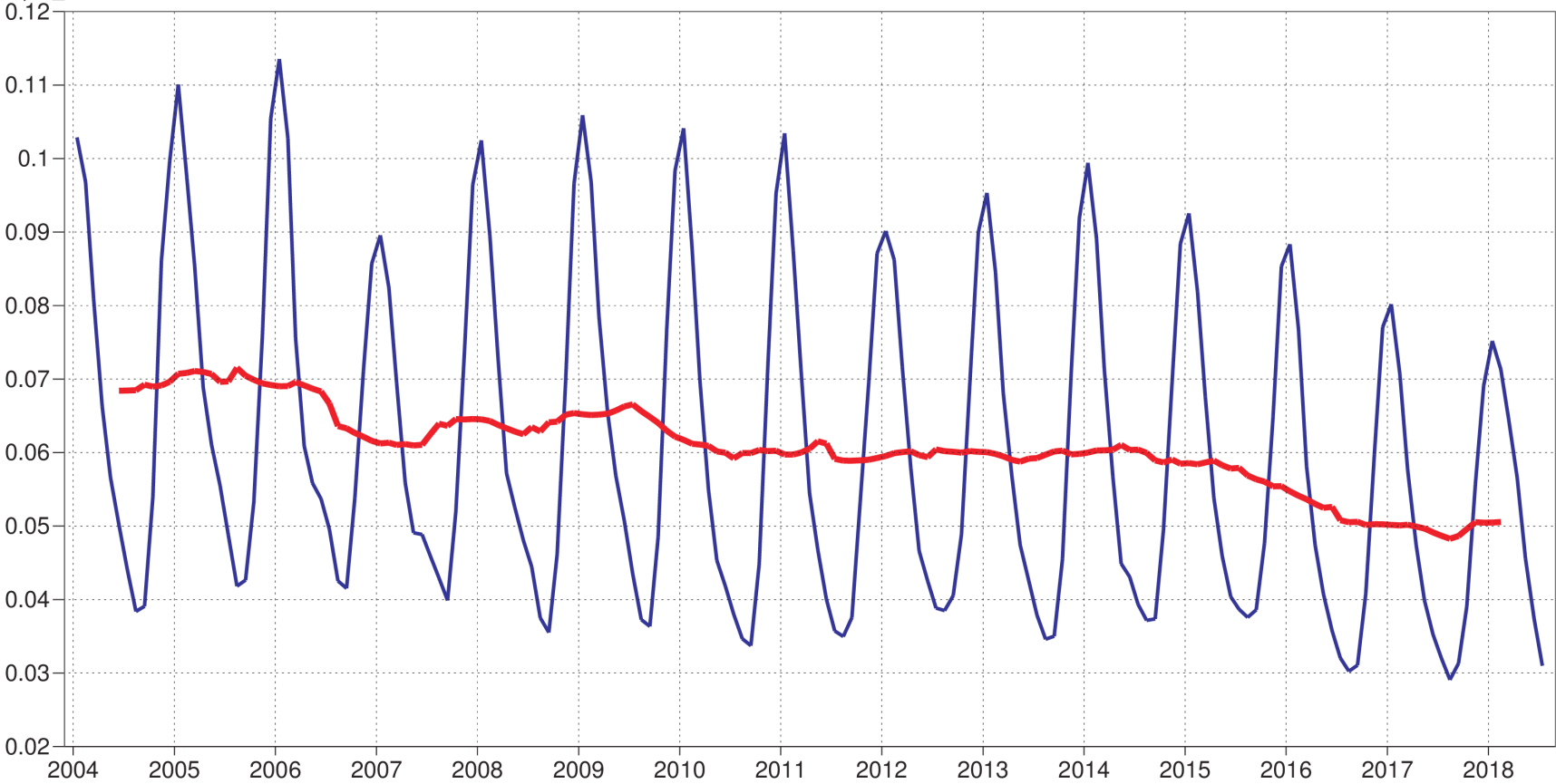
CRPSS=25%

CRPSS=50%

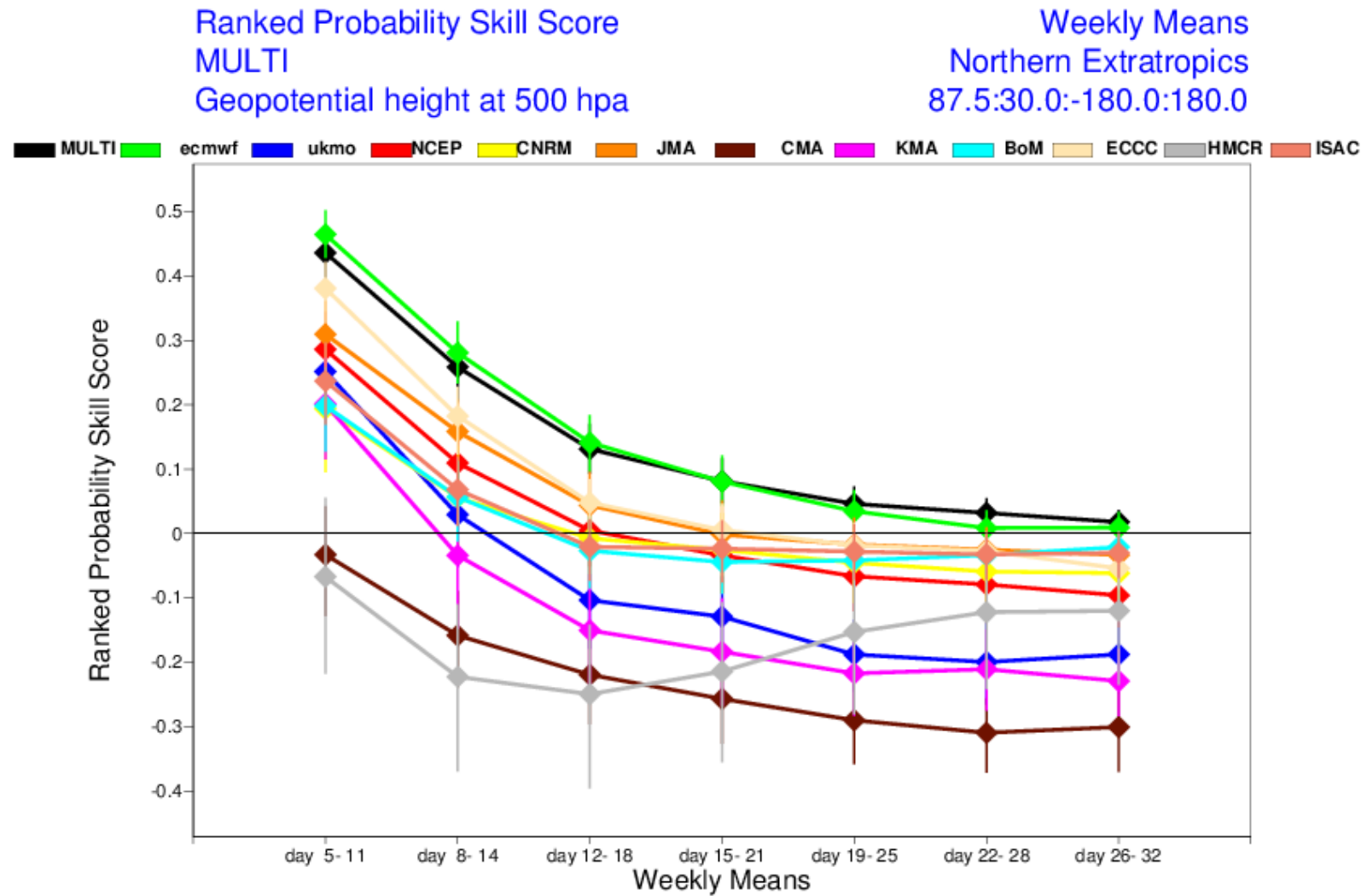
Fraction of large T2M errors - ENS

2 meter temperature
Fraction of large CRPS value >5.0
Extratropics (lat -90 to -30.0 and 30.0 to 90, lon -180.0 to 180.0)
T+120
oper_ob od enfo 0001

00UTC,12UTC [running mean 730]
00UTC,12UTC [running mean 180]



Collaborations and serving community: S2S project



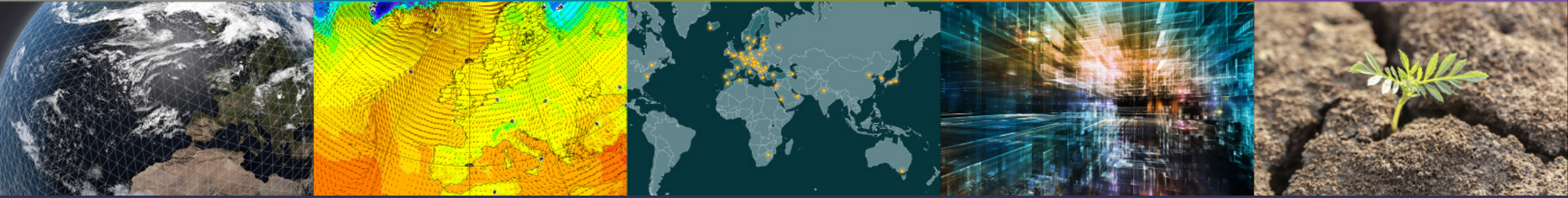
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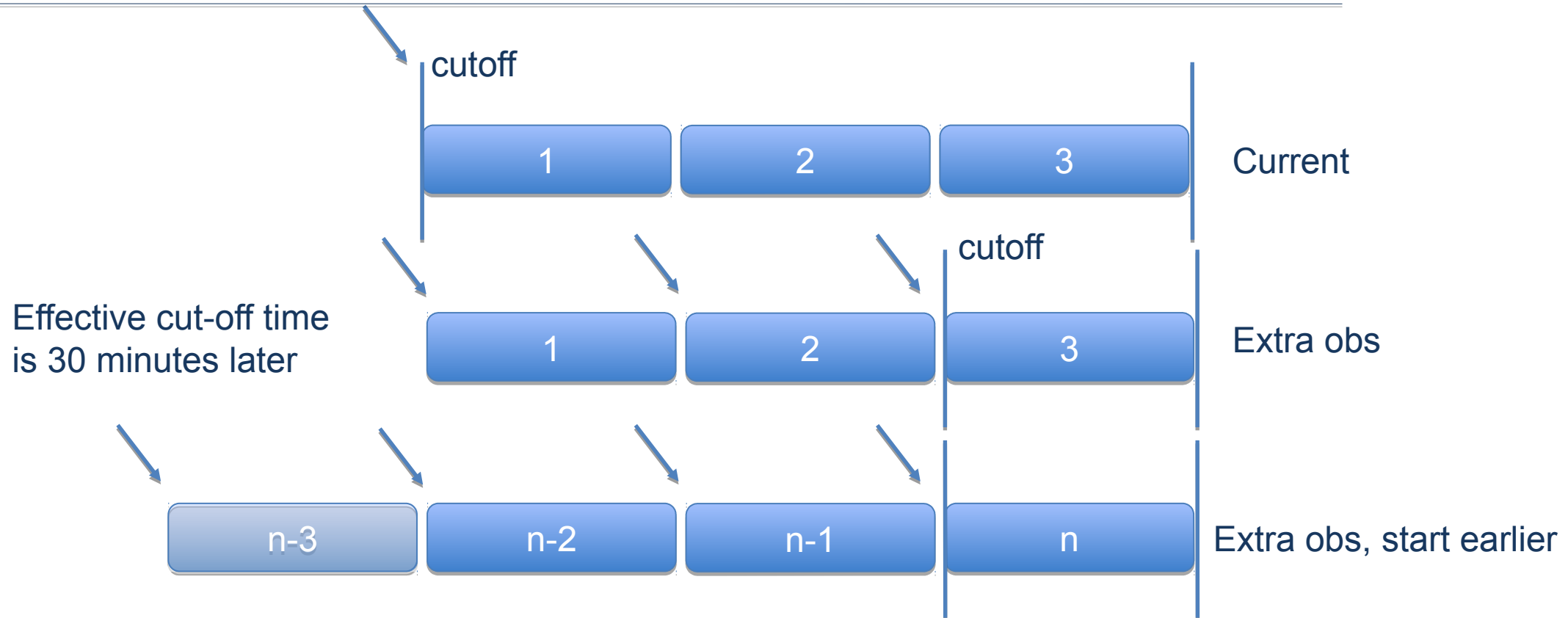
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Advancing weather science

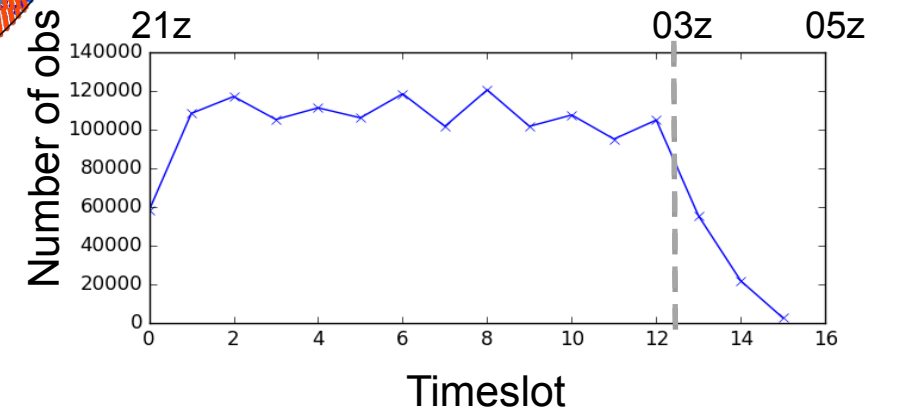
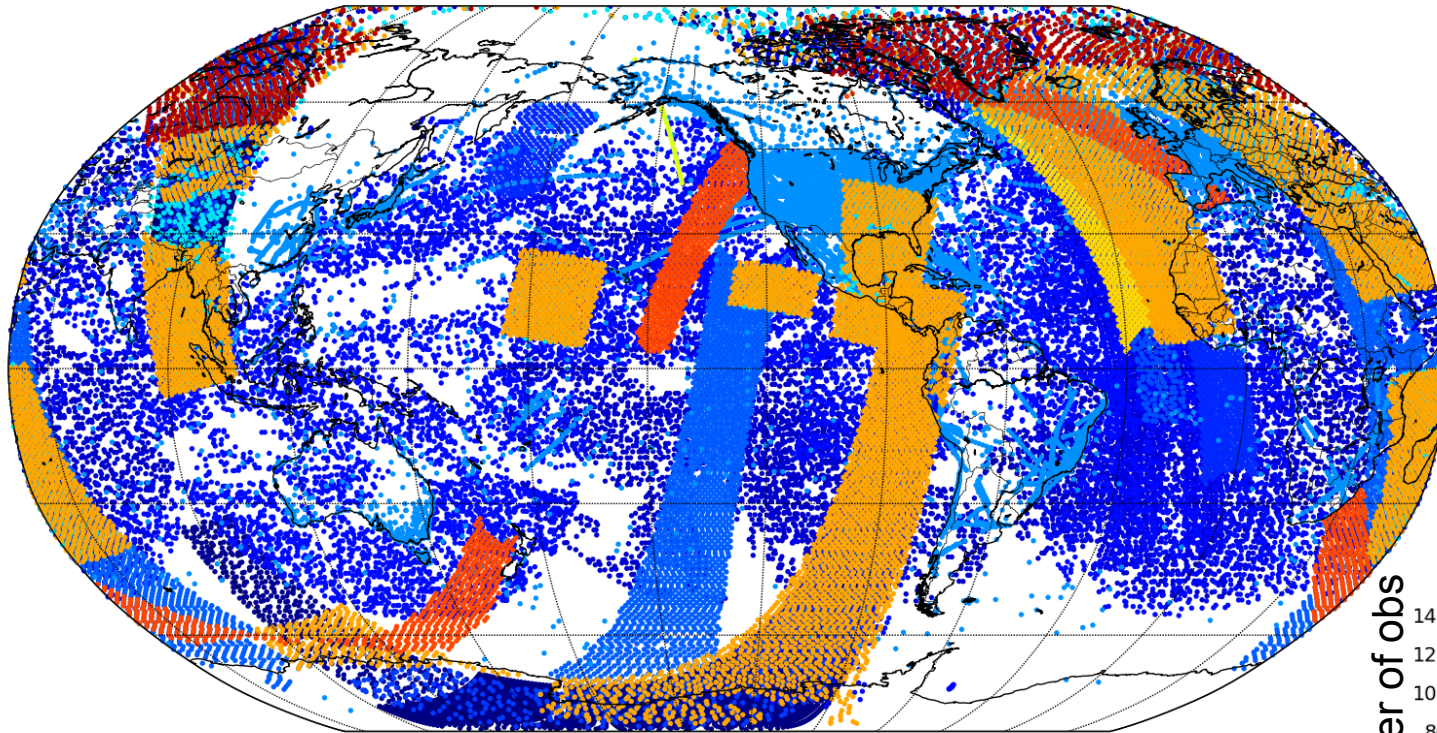


Continuous data assimilation



- Key point: Start running data assimilation **before** all of the observations have arrived
 - Most of the assimilation is removed from the time critical path
 - Configurations which were previously unaffordable can now be considered.
- Opens the possibility of a fully continuous assimilation system.

Extra observations assimilated in Continuous DA configuration

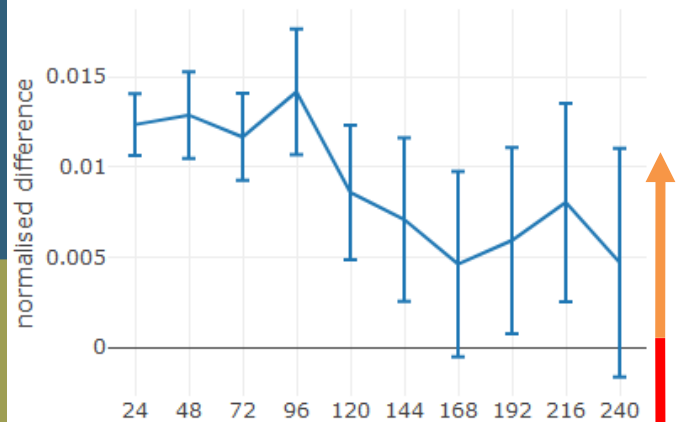


Impact of 1 hourly radiation on ENS

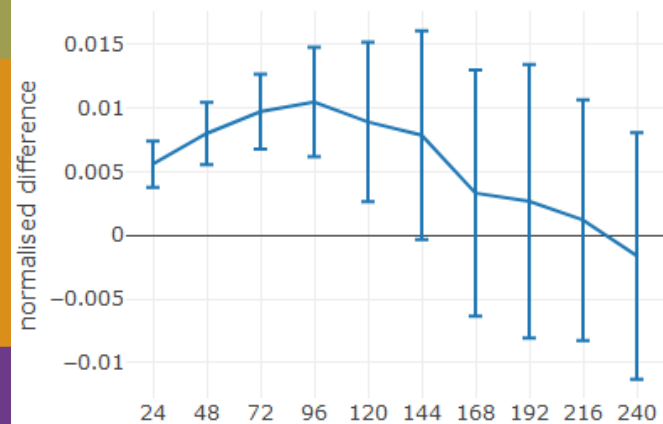
Experiments: TCo639, 50 members, 91 levels, June-August, 44 inidates

z500 CRPS

z500_n.hem_crps_an

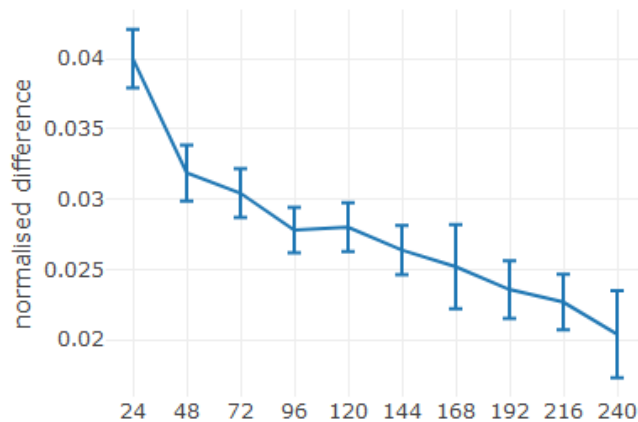


z500_s.hem_crps_an

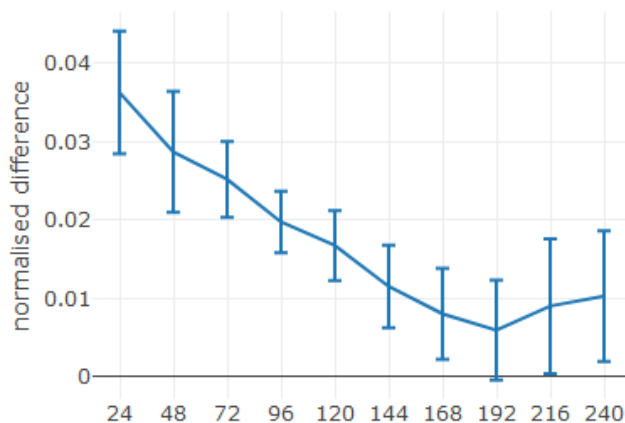


2t CRPS

2t0_tropics_crps_an



2t0_europe_rmsef_an



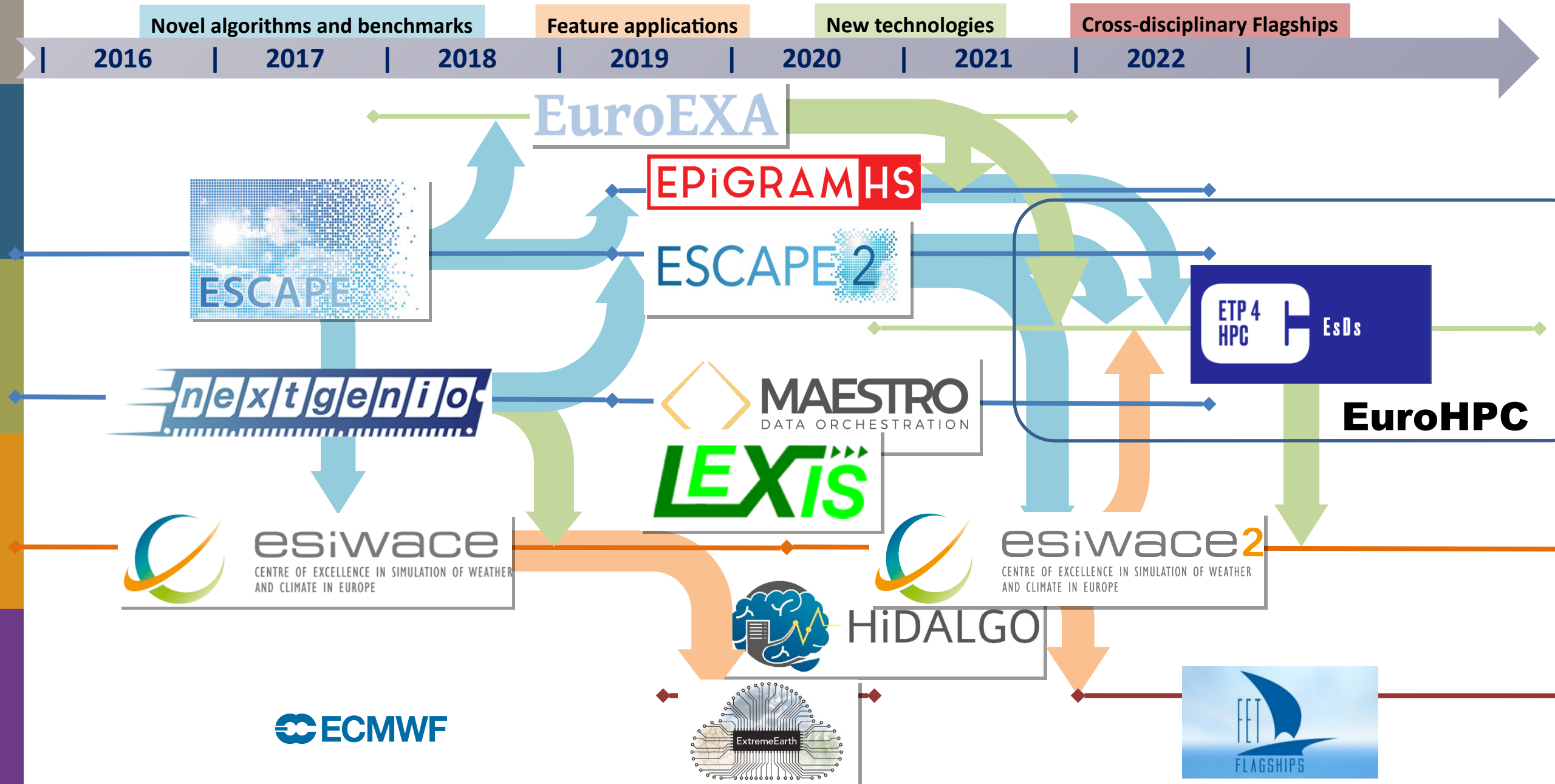
vs Analysis

vs Obs

		n.hem		s.hem		tropics	
		rmsef	crps	rmsef	crps	rmsef	crps
anz	100						
	250						
	500						
	850						
msl	100						
	250						
	500						
	850						
t	100						
	250						
	500						
	850						
ff	100						
	250						
	500						
	850						
r	200						
	700						
2t	100						
	250						
10ff@sea	100						
	250						
swh	100						
	250						
mwp	100						
	250						
obz	100						
	250						
	500						
	850						
t	100						
	250						
	500						
	850						
ff	100						
	250						
	500						
	850						
r	200						
	700						
2t	100						
	250						
2d	100						
	250						
tcc	100						
	250						
10ff	100						
	250						
tp	100						
	250						

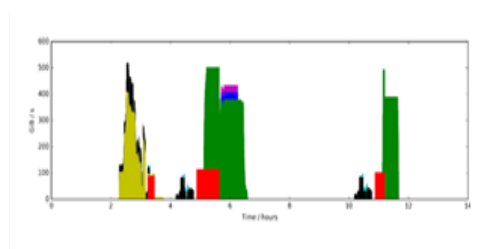
- clear improvement in scores! 3% cost increase (~ 2 minutes runtime)
- additional benefit: consistency with HRES, good for future development

Scalability: ECMWF computing and data roadmap in H2020

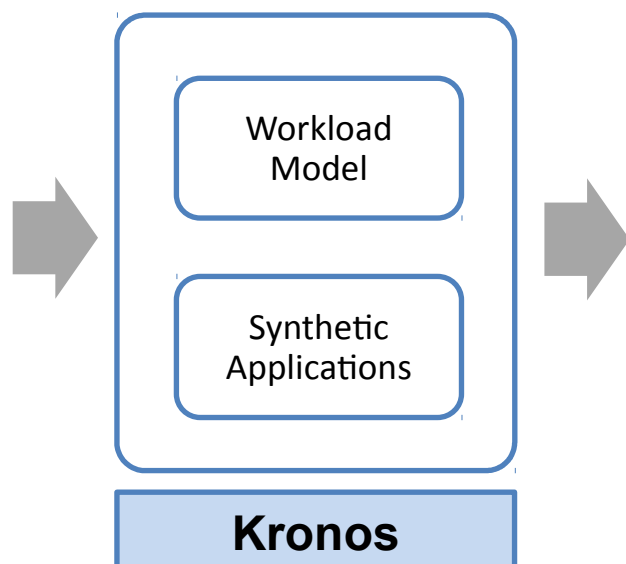


Kronos workload simulator as a HPC benchmark

- **Kronos tests HPC systems by deploying realistic workloads:**
 1. a workload model is generated from **HPC workload profiling data**
 2. the workload model is then translated (and scaled) into a **schedule of representative and easily-portable applications**
 3. Kronos models and tests **Compute, Interconnect, I/O subsystems**

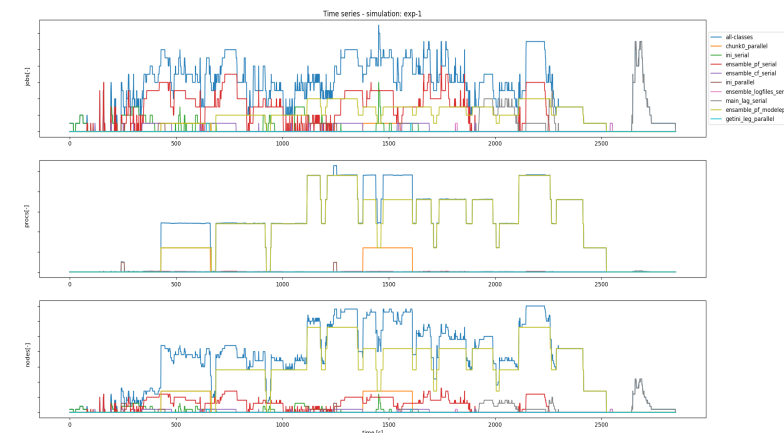


HPC Workload profiles

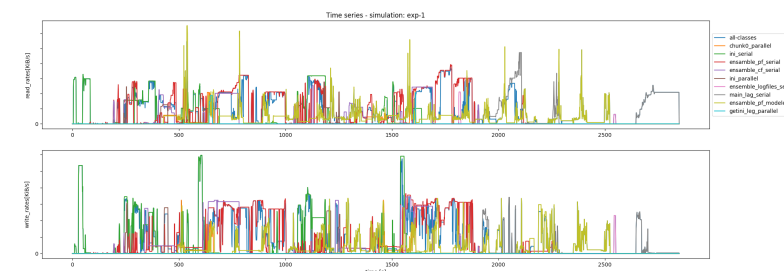


HPC prototype to be tested

Post-processing



E.g. Workload execution profiles



E.g. I/O time-profiles

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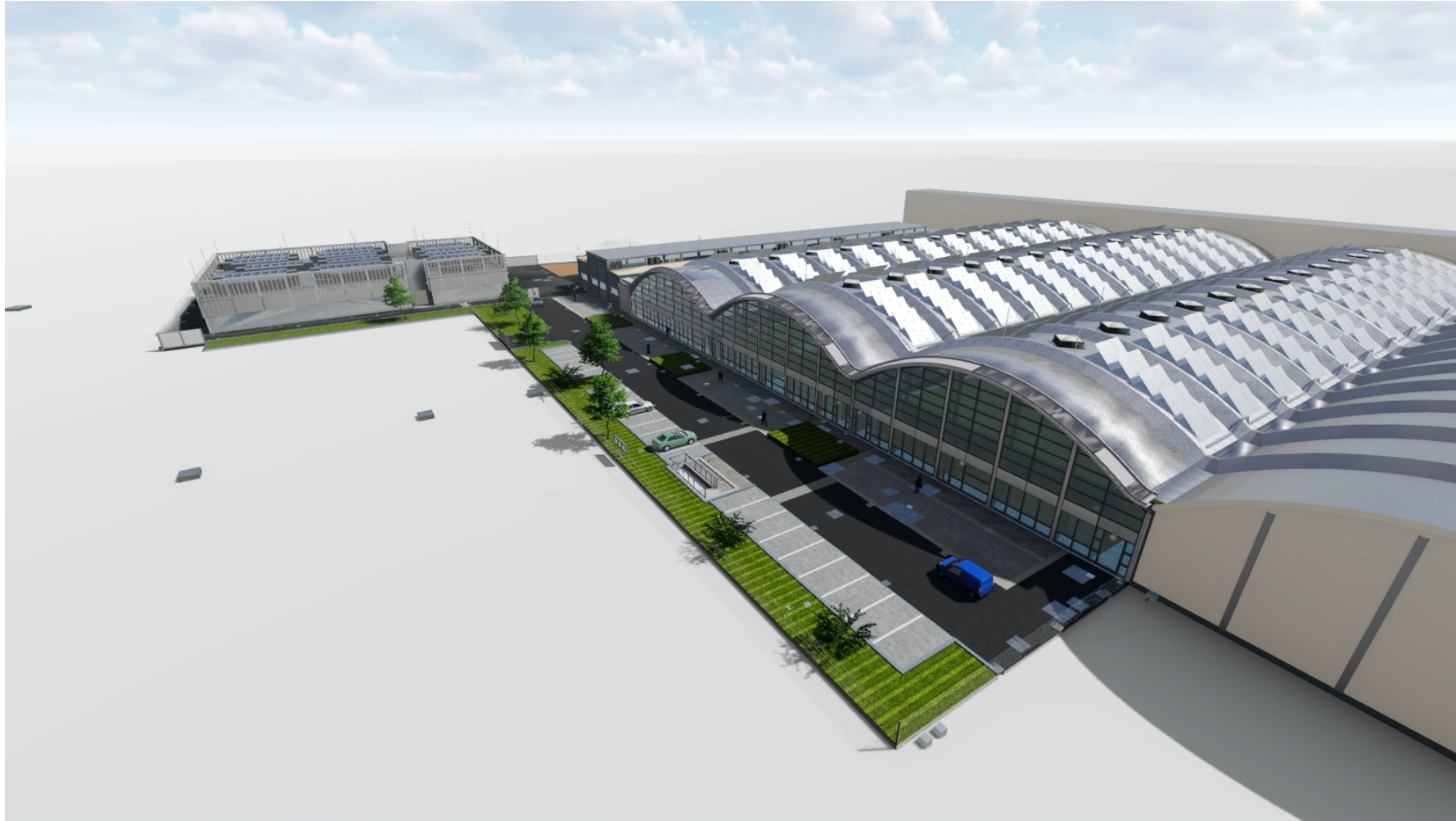
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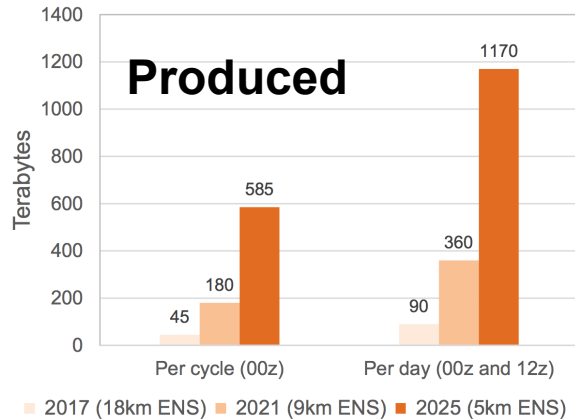
Sustaining HPC and Big Data



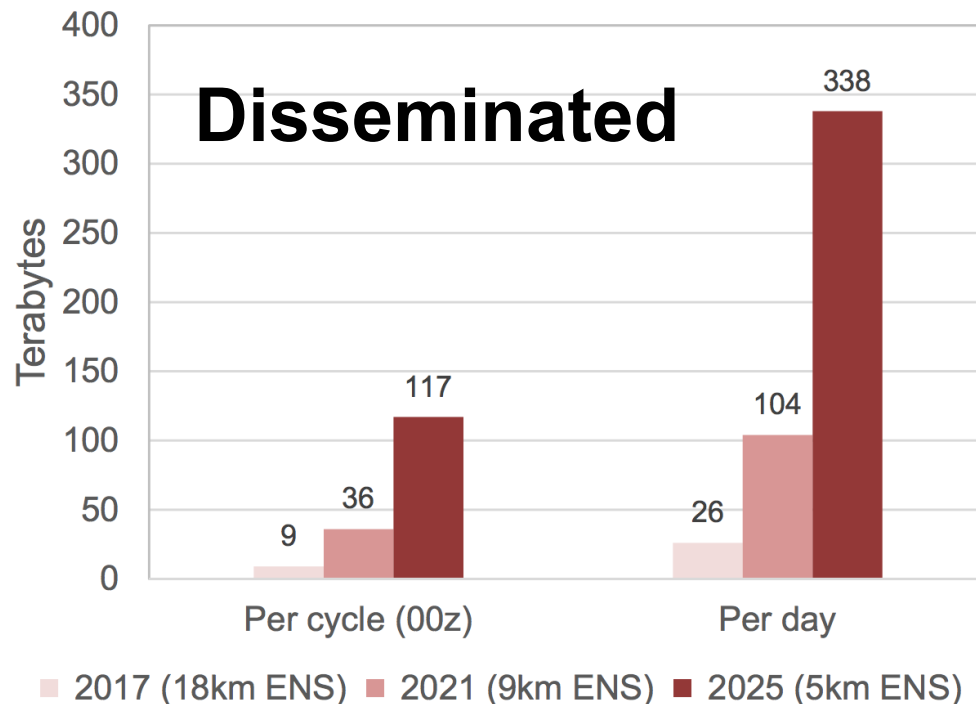
Our Future Datacentre – Bologna, Italy



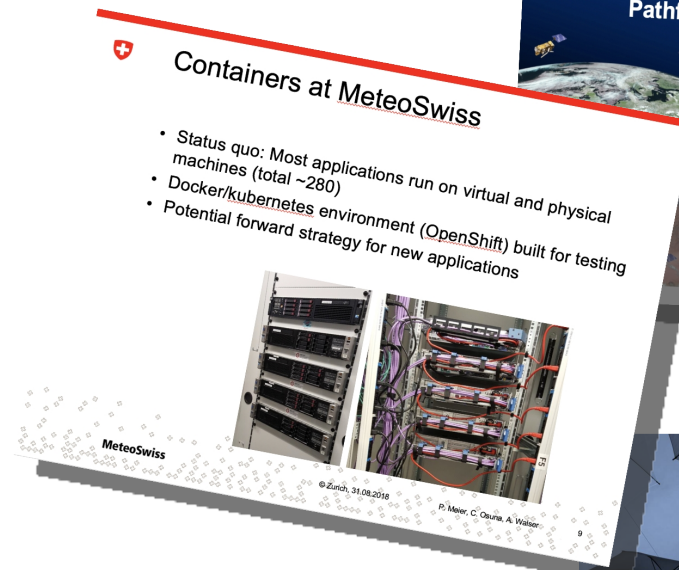
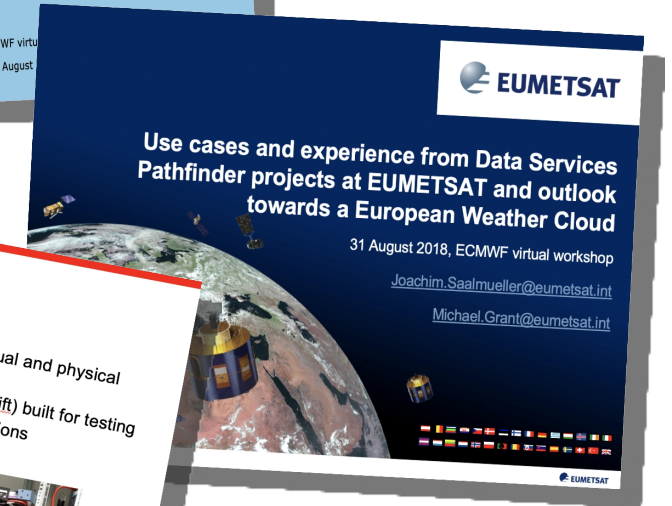
BIG DATA - CONTEXT



ECMWF outputs are constantly increasing and a gap already exists



Cloud Computing
Virtual Workshop,
31 August (60+
participants)



Compelling use
cases across the
EMI



ESTABLISHING THE EUROPEAN WEATHER CLOUD (EWC)



- converge discussions started in the context of ECMWF and EUMETSAT respective committees, but also taking place at EUMETNET, ECOMET and ICWED
- consider the risks, limitations and threats of relying fully on commercial Cloud Computing providers for ensuring some of our most crucial functions
- propose a Cloud Computing-based infrastructure, focused on the needs of the meteorological community and building on the expertise and meteorological data owned by the two organisations**
- enable any entity of the EMI to join the infrastructure
- build on the experience gained by E & E in Cloud Computing

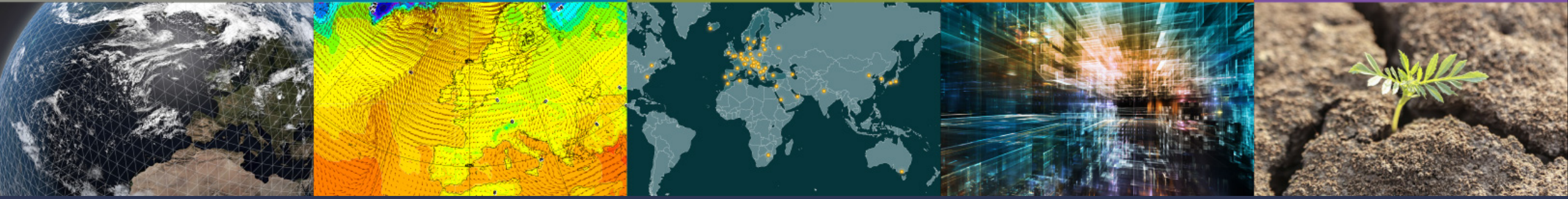
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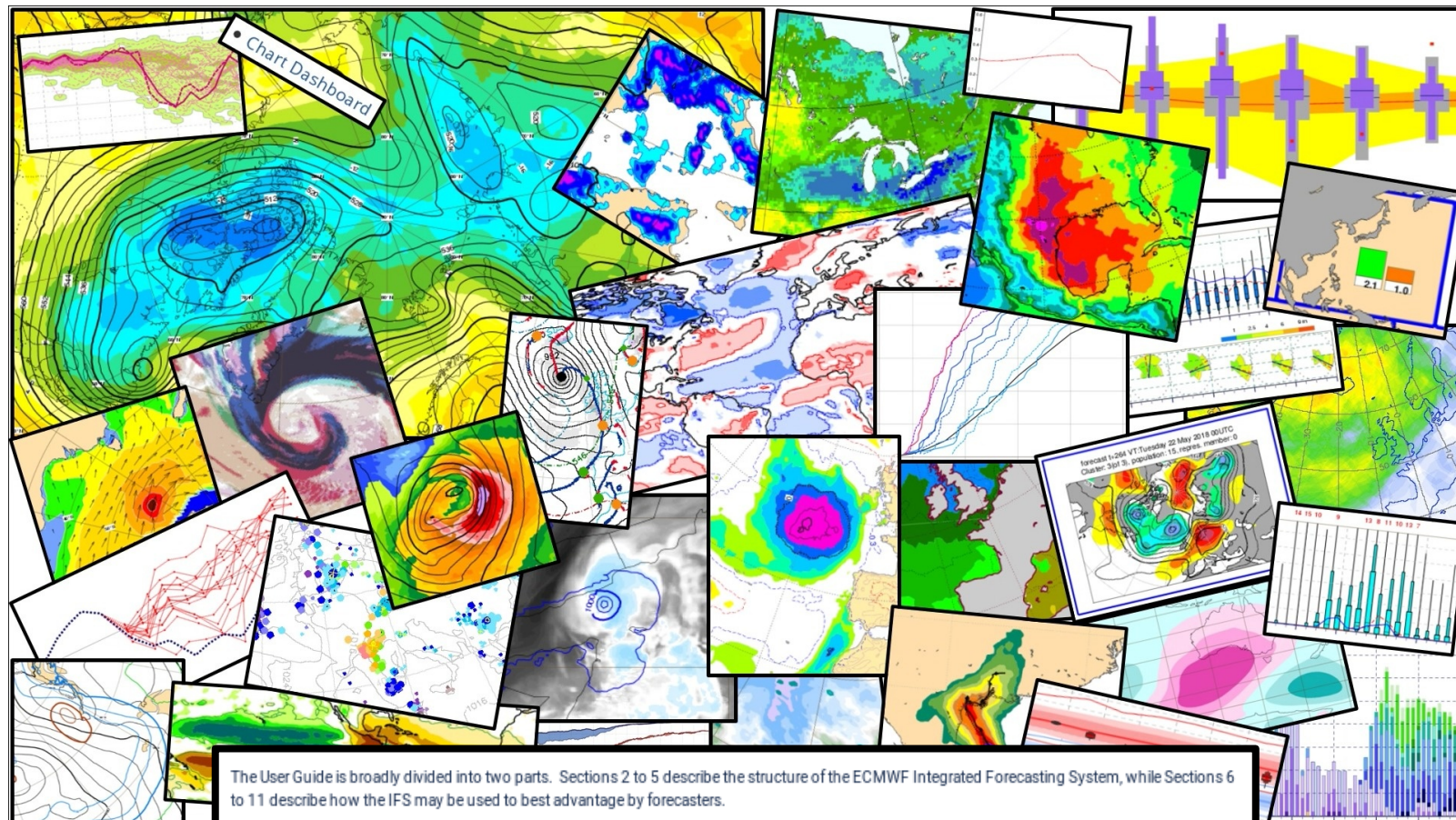
Serving Member and Cooperating States



Collaborations and serving community: WORKSHOPS

- Workshop on shedding light on the greyzone
- Workshop on developing Python frameworks for earth system sciences
- ECMWF/ESA workshop on using low frequency passive microwave measurements in research and operational applications
- Workshop on observations and analysis of sea-surface temperature and sea ice for NWP and climate applications
- Workshop: Hydrological services for business
- Workshop: Radiation in the next generation of weather forecast models
- Workshop on Member and Co-operating State requirements for ECMWF outputs in support of multi-hazard Early Warning Systems
- Using ECMWF's forecasts (UEF2018)
- Hackathon: "Innovate with Open Climate Data"
- Workshop on physics-dynamics coupling 2018 (PDC18)
- Radio-Frequency Interference (RFI) workshop
- Annual Seminar: Earth system assimilation
- 18th Workshop on high performance computing in meteorology





The User Guide is broadly divided into two parts. Sections 2 to 5 describe the structure of the ECMWF Integrated Forecasting System, while Sections 6 to 11 describe how the IFS may be used to best advantage by forecasters.

A glossary is included in an Appendix.

- Section2: The ECMWF Integrated Forecasting System (IFS)
- Section3: Availability and interpolation of NWP output
- Section4: NWP evolution versus reality
- Section5: Forecast ensemble (ENS) - rationale and construction
- Section6: Using HRES and ENS forecasts
- Section7: Dealing with uncertainty
- Section8: ENS products - what they are and how to use them
- Section9: Physical considerations when interpreting model output
- Section10: Interfaces for displaying model output
- Section11: Conclusion
- Section12: Appendices

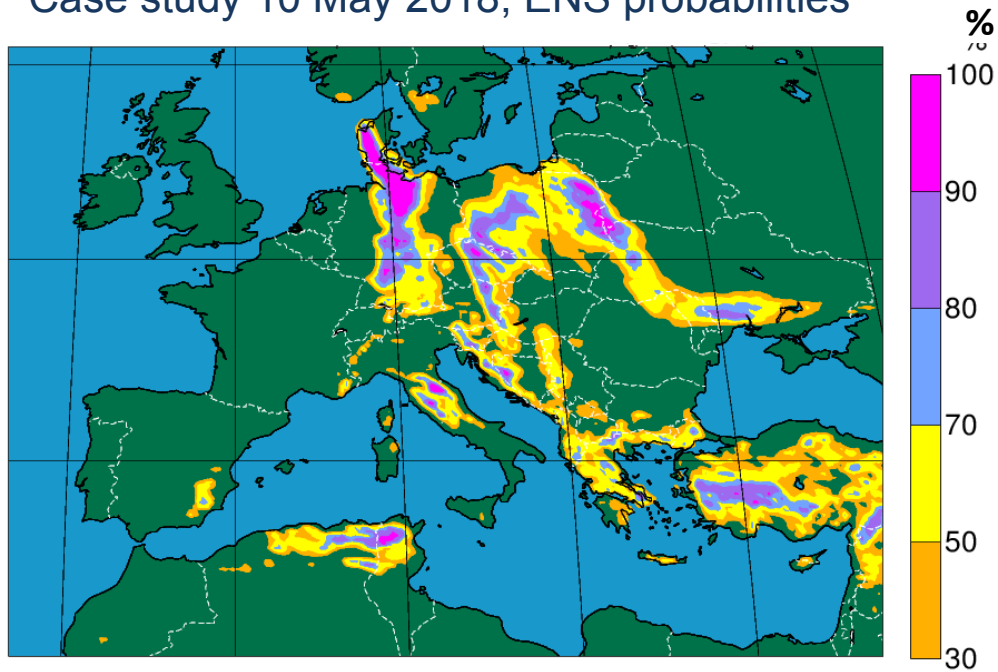
“Forecast User Guide”

- A new and a vastly updated web-based version of this document was released to MS/CS and other users in May 2018, in the forecast_user portal
- It provides helpful information, for forecasters in particular, on these and other topics:
 - how the model formulations work (in relatively simple terms)
 - what ECMWF products are and how to make best use of them
 - where and when user expectations, regarding forecast accuracy, can be elevated or lowered
- This is a live document, undergoing frequent updating, as and when models and products change and our understanding of them improves

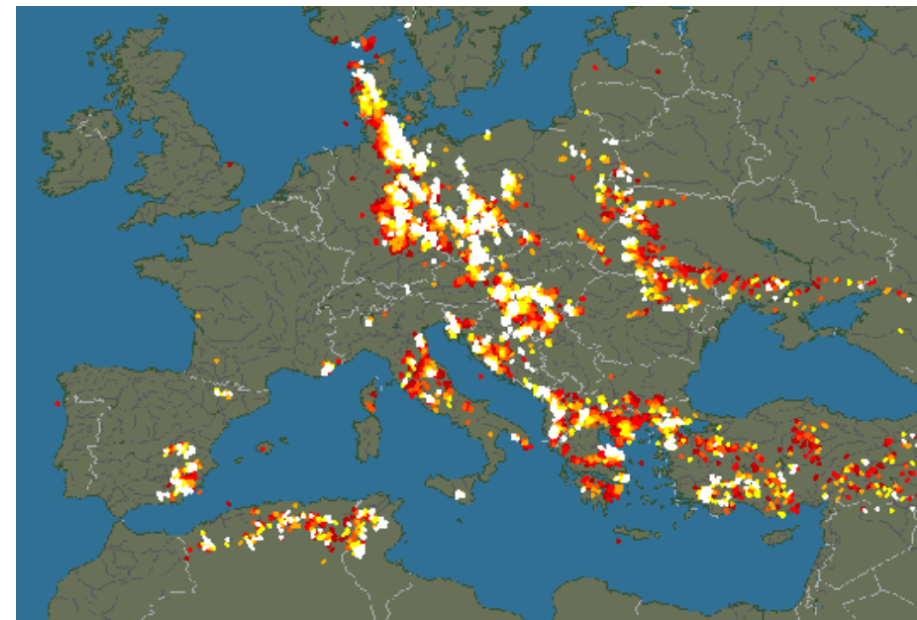
Useful diagnostics of extreme events

Probability of lightning flash density from ENS

Case study 10 May 2018, ENS probabilities



Observed lightning strikes (Blitzortung.org)



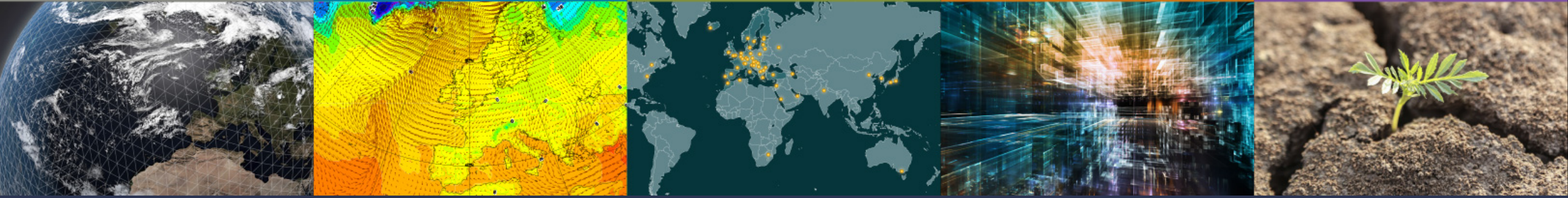
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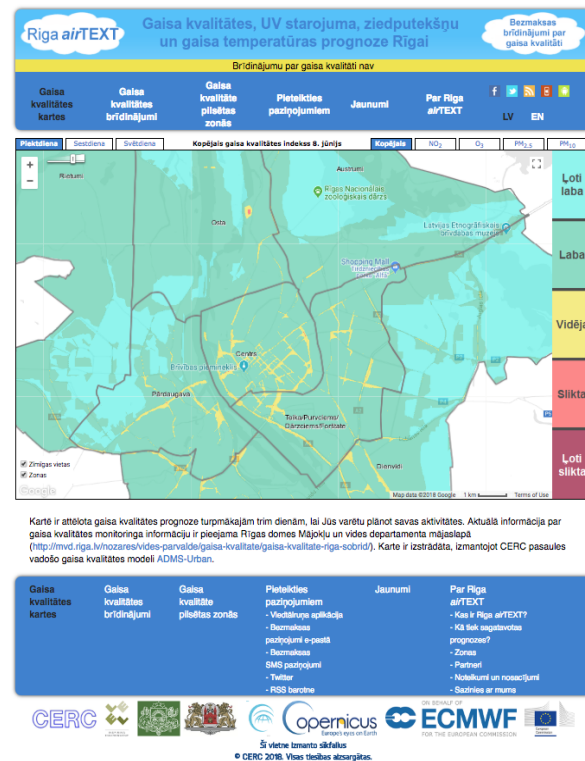
Copernicus @ ECMWF



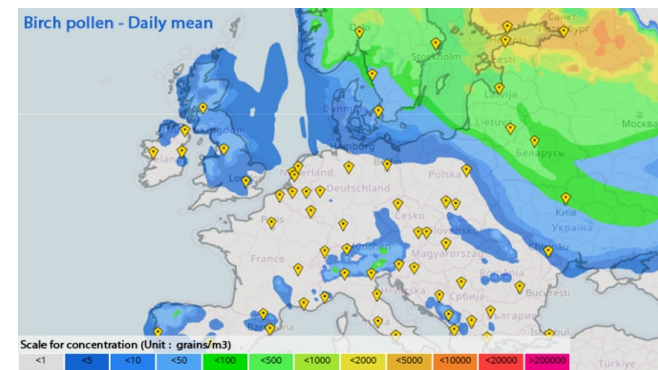
Successful uptake of ECMWF Copernicus products

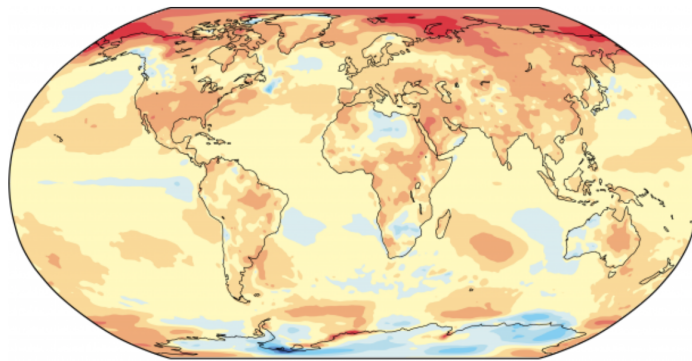
CAMS and C3S **direct users** = a few tens of thousands
...**Actual reach** is much larger!

AirText Riga
265000 visits
in first month...



MétéoPollen
10,000 downloads
first month in Apple
appstore.





-10 -5 -3 -2 -1 -0.5 0 0.5 1 2 3 5 10
Difference of 2017 temperature (°C) from the 1981-2010 average

WMO confirms 2017 among the three warmest years on record

Tags: [Climate change](#) [Greenhouse gases](#) [Climate](#)

18

Published 18 January 2018

Press Release Number: 18-01-2018

18 January 2018 (WMO) - In a clear sign of continuing long-term climate change caused by increasing atmospheric

[Latest WMO News](#)

European State of the Climate 2017

Summary



4 years of development towards a European Climate Service of reference

A one-stop Climate Data Store



We have built a store.

The door opened to customers in June 2018

We continuously put products on the shelves.

Open and freely available data

Climate data records

cds.climate.copernicus.eu



ECMWF contribution to C3S

ERA5 is in production at ECMWF for C3S

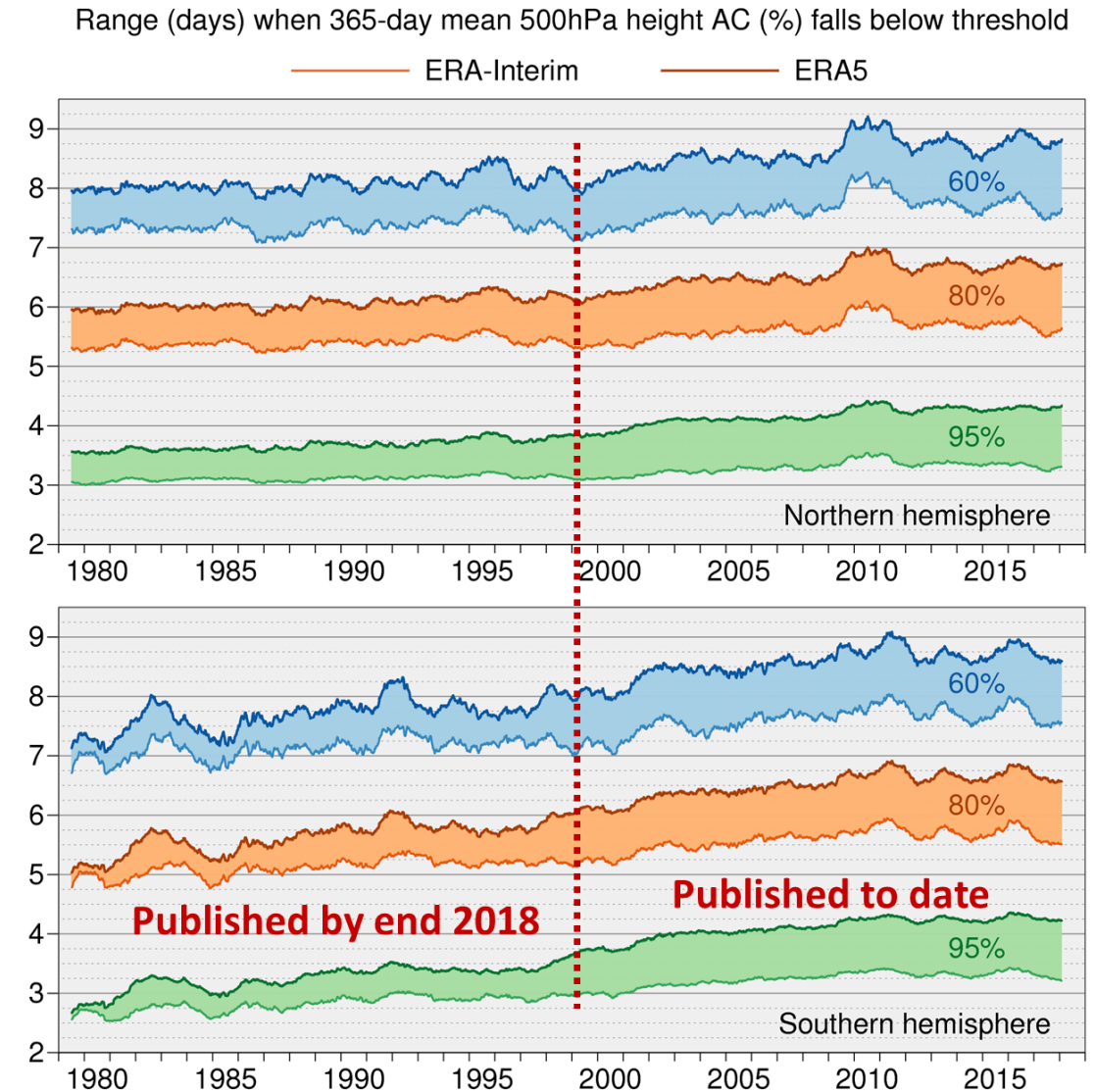
ERA5 will replace ERA-Interim

Improvements compared to ERA-Interim:

- Benefit from 10 years model development
- Much higher resolution; **31km** versus 80km
- More and better input data
- Hourly output
- Uncertainty estimate (at 62km)
- Will reach further back in time (1950 versus 1979)

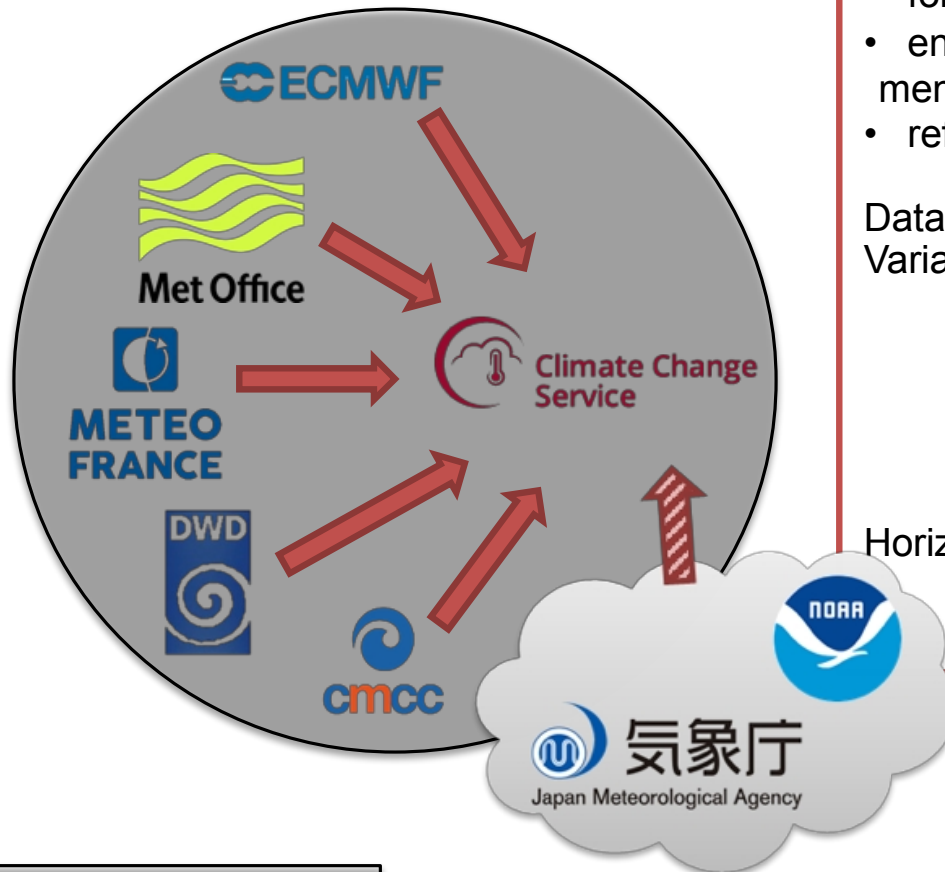
CDS public release plan:

- **Published to date: 2000–2018**,
updates 2-months behind real time
- **Before end 2018: 1979 onwards**,
updates 2-5 days behind real time: **ERA5T**
- **Mid 2019: 1950-1978**.
Production of ERA-Interim is no longer supported
- **Mid 2019:** Production of ERA5-land (**1979 onwards**) completed



Forecasts from ERA5 analyses have higher skill than those from ERA-Interim.

ECMWF Contribution to C3S



Protocol:

- time of submission of data; time of publication of forecasts (13th of each month)
- ensemble size (forecasts: ~50 members; hindcasts: ~25 members)
- reference period: 1993-2016 (24 years)

Data:

Variables

- Surface
 - 9 vars every 6h
 - +20 vars every 24h
- Pressure (11 levels, from 925 hPa to 10 hPa)
 - 5 vars every 12 h

Horizontal grid: global 1deg x 1deg

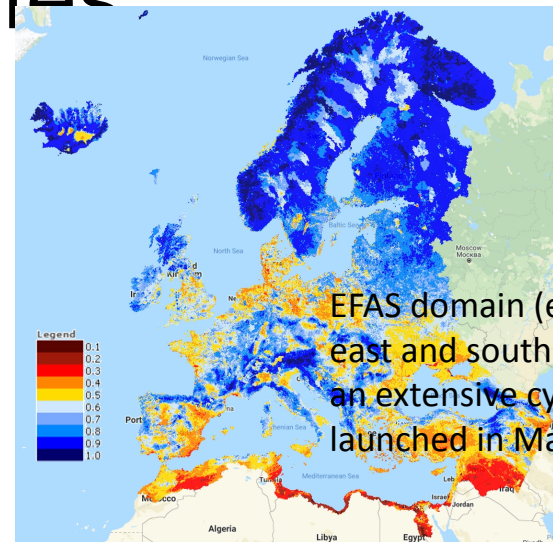
Agreed netCDF specification C3S-0.1 (based on CF)

Also likely: ECCO and BoM

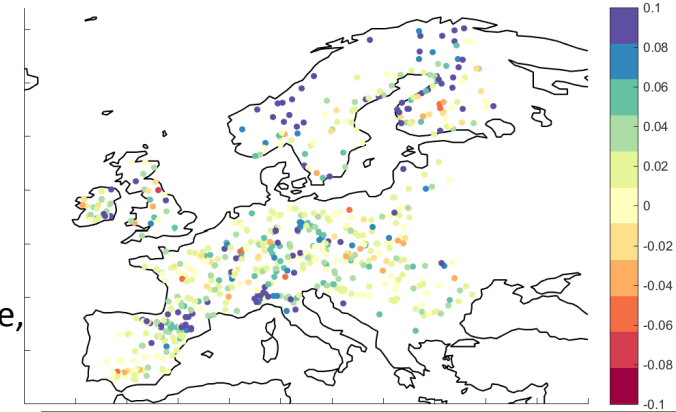
Copernicus Emergency Management Services (Floods and Fire) – 2018 activities



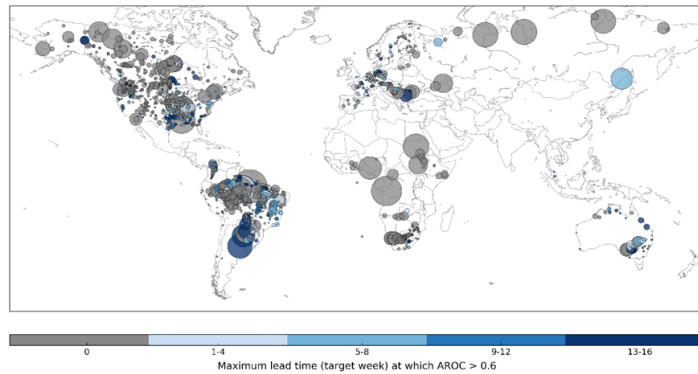
New EFAS web interface extensively tested by users in summer 2018, to be launched Dec 2018



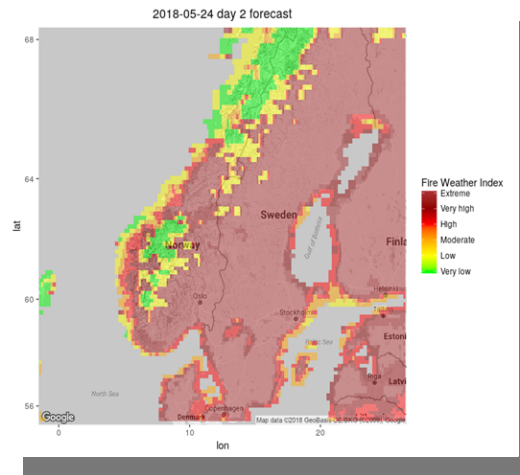
EFAS domain (extended east and south) following an extensive cycle upgrade, launched in May 2018



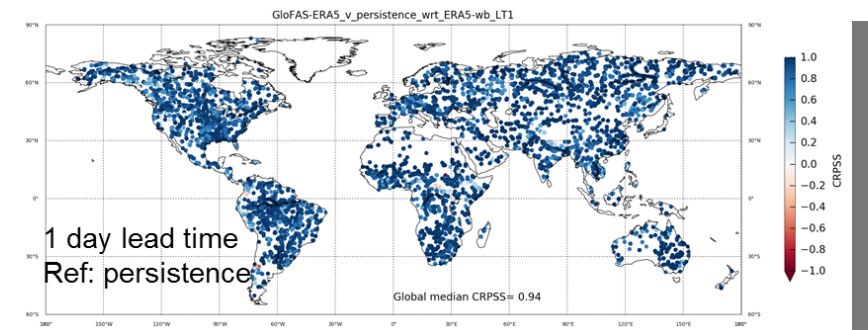
Skill improvement (blue and green) in EFAS summer 2016 hydrological forecasts when using prototype calibrated rainfall forecasts (3-day lead time)



Maximum lead time of skilful high flow forecasts produced by GloFAS Seasonal. Based on SEAS5. Dot size show catchment area. Available as a pre-operational service since Nov 2017



EFFIS Fire Weather Index for the 24 May 2018, 2-day lead time, ran operationally by ECMWF



Skill in GloFASv2.0 cycle hydrological forecasts (1-day lead time) to be launched Nov 2018, following full operationalisation of GloFASv1.0 in May 2018



The strength of a common goal